

Remarks

Reconsideration and the timely allowance of the pending claims, in view of the following remarks, are respectfully requested.

In the pending Office Action, the Examiner rejected claims 1-5, under 35 U.S.C. §103(a), as allegedly being unpatentable over Grover '917 (U.S. Pat. No. 5,795,917) in view of Akahori '538 (EP 1148538); and rejected claims 6-17, under 35 U.S.C. §103(a), as allegedly being unpatentable over Kido '111 (EP 1061111) in view of Akahori '538 and Matthew '082 (WO-96/11082).

By this Amendment, claims 1, 6 and 13 have been amended for form and clarity, claims 2-5, 8-12, and 14-17 have been cancelled, and new claims 18-20 have been added. No new matter has been added. As such, claims 1, 6-7, 13, and 18-20, are currently presented for examination of which claims 1, 6, and 13 are independent.

Applicants traverse the §103(a) rejections for the following reasons:

I. Rejections Under §103(a).

As noted above, independent claim 1 is directed to a chemical-mechanical-polishing slurry composition and positively recites, *inter alia*, the following features:

- (1) the composition includes ceria polishing particles, a dispersing agent, and an anionic additive;
- (2) the anionic additive is added to control a concentration of the anionic additive so that a polishing-rate selection ratio of an oxide layer to a nitride layer is 40 : 1 or greater;
- (3) the ceria polishing particles are polyhedron;
- (4) a particle size of the ceria polishing particles is within a range from 148 nm to 290nm;
- (5) the ceria polishing particles are polycrystalline particles of which grain boundaries are 100 nm or larger; and
- (6) the anionic additive is water-soluble polyacrylic acid or water-soluble polycarboxylate.

- (7) a concentration of the anionic additive is from 0.1 to 0.6 wt% in relation to the entirety of the slurry composition.

Applicants submit that these features are amply supported by the embodiments disclosed in the written description. For example, in claims 1, 6, and 13, the feature of "a particle size of the ceria polishing particles is within a range from 148 nm to 290nm" is based on previous claim 2 and Specification: page 24, lines 5 to 7. In claims 1, 6, and 13, the feature of "the ceria polishing particles are polycrystalline particles of which grain boundaries are 100 nm or larger" is based on claims 3, 9, and 15 and Specification: page 21, lines 14 to 15. In claims 1, 6, and 13, the feature of "the anionic additive is water-soluble polyacrylic acid or water-soluble polycarboxylate" is based on claims 4, 10, and 16. In claims 1, 6, and 13, the feature of "a concentration of the anionic additive is from 0.1 to 0.6 wt% in relation to the entirety of the slurry composition" is based on claims 5, 11, and 17. The features of previous claims 8 and 12 are added to claim 6 and the features of previous claim 14 are added to claim 13. Newly added claims 18 to 20 are based on Specification: page 24, lines 5 to 7 and 10 to 11.

In accordance with the claim features (1) to (7), the disclosed embodiments provide that, while the polishing-rate selection ratio of an oxide layer to a nitride layer is 40:1 or greater, a very high ablating rate (about 3500 Å/min) of the oxide film can be achieved (*see, e.g.*, slurry A in FIG. 13). Also, as shown in FIG. 18, it can be confirmed that very high ablating rates of the oxide film can be achieved within a range of about 3500 to 4000 Å/min (*see, e.g.*, slurries A1 and A2 in FIG. 18). Therefore, the oxide film can be selectively ablated at a very high ablating rate.

However, in the case of slurry B, which contains aggregation of mono-crystalline particles having sizes within a range 40 to 60 nm and in which claim features (4) and (5) are not met, only a relatively low ablating rate (about 500 Å/min) of the oxide film can be obtained (*see, e.g.*, slurry B in FIG. 13). As is clear from the comparison with the results of slurry B, a significant effect can be attained by satisfying the features (1) to (7) of the presently claimed invention.

Applicants submit that none of the asserted references, whether taken alone or in reasonable combination, remotely suggest each and every element of claim 1 including, for example, the features identified above. To be clear and to the point, none of the references, namely, Grover '917, Akahori '538, Kido '111, and Matthew '082, even when taken in combination, reasonably suggest all of claim features (1)-(7), noted above. Equally notable, artisans of ordinary skill will attest that the applied combination of references is incapable of selectively ablating that the oxide film at a very high ablating rate. As such, independent claim 1 is patentable over the applied references.

With regard to claim 18, the claim depends from claim 1 and is, therefore, patentable by virtue of dependency as well as for its additional recitations. In particular, claim 18 additionally recites

- (8) the particle size of the ceria polishing particles is about 148 nm or about 290nm; and
- (9) the dispersing agent is poly-metha-acrylic ammonium salt.

In accordance with the feature (8), very high values within a range of about 3500 to 4000 Å/min can be attained as the ablating rate of the oxide film (see, Specification: slurries A1 and A2 in FIG. 18). In the case where the anionic additive is water-soluble polyacrylic acid or water-soluble polycarboxylate (feature (6)), superior polishing-rate selection ratio of an oxide layer to a nitride layer can be attained.

Moreover, poly-metha-acrylic ammonium salt (feature (9)) has good affinity to water-soluble polyacrylic acid and water-soluble polycarboxylate. Therefore, in accordance with the feature (9), ceria polishing particles can be uniformly dispersed without deteriorating the effects of water-soluble polyacrylic acid and water-soluble polycarboxylate.

With this said, there are absolutely no examples, suggestions, or descriptions in Grover '917, Akahori '538, Kido '111, and Matthew '082 which contain ceria polishing particles satisfying claim features (5)-(8). Also, no examples are disclosed which contain water-soluble polyacrylic acid or water-soluble polycarboxylate, as required by claim feature

(6) together with poly-metha-acrylic ammonium salt of claim feature (9). As such, claim 18 is clearly patentable over the applied references.

Regarding independent method claims 6 and 13, Applicants point out that these claims also recite claim features (1) to (7) noted above, and are, therefore, patentable for at least similar reasons as independent claim 1.

Moreover, claim 6 additionally recites the following claim feature:

- (10) ablating the oxide layer by using a silica slurry before the surface of the nitride layer is exposed.

In accordance with claim feature (10), the oxide layer can be ablated at a higher ablating rate before the surface of the nitride layer is exposed. Therefore, the time required for the surface planarization can be greatly shortened. Once again, there is nothing in any of Grover '917, Akahori '538, Kido '111, and Matthew '082 that remotely suggest such a feature. As such, independent claim 6 is clearly patentable over the applied references. And because claims 7 and 19 depend from claim 6, claims 7 and 19 are patentable at least by virtue of dependency as well as for their additional recitations.

Finally, independent claim 13 recites similar claim features (1) to (7) as claim 1. As such, claim 13 is patentable for at least similar reasons as claim 1. And, because claim 20 depends from claim 13, claim 20 is patentable at least by virtue of dependency as well as for their additional recitations.

Accordingly, the immediate withdrawal of the §103(a) rejections is respectfully requested.

Conclusion

Having addressed each of the foregoing rejections, it is respectfully submitted that a full and complete response has been made to the outstanding Office Action and, as such, the application is in condition for allowance. Notice to that effect is respectfully requested.

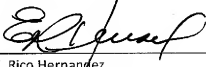
If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

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